**U.S. FISH AND WILDLIFE SERVICE**
**SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Festuca hawaiiensis*

COMMON NAME: No common name

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: August 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

_X__ Continuing candidate

___ Non-petitioned

_X__ Petitioned - Date petition received: May 11, 2004

__ 90-day positive - FR date:

_X_ 12-month warranted but precluded - FR date: May 11, 2005

_N_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov).

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): 1990

___ Candidate removal: Former LP: __

___ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Poaceae (Grass family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Hawaii and Maui

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Hawaii

LAND OWNERSHIP: This species is known to occur on lands owned or leased by the U.S. Army and the State of Hawaii.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Festuca hawaiiensis* is a cespitose annual with numerous erect culms 5 to 15 decimeters (1.6 to 5 feet (ft)) tall, branching somewhat above base, glabrous to slightly puberulent. Sheaths are open and blades flat and smooth, 25 to 40 centimeters (cm) (10 to 16 inches (in)) long, and 3 to 12 millimeters (mm) (0.12 to 0.5 in) wide. Inflorescences are paniculate, composed of six to eight alternate racemes, with a flattened rachis, and are puberulent and winged. The fruits are ellipsoid, dorsally compressed, and 1.5 to 5 mm (0.06 to 0.2 in) long (O'Connor 1999).

Taxonomy *Festuca hawaiiensis* was described by A. S. Hitchcock. This species is recognized as a distinct taxon in O'Connor (1999) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy.

Habitat Typical habitat is dry forest at an elevation of 2,000 meters (6,562 ft) (O'Connor 1999).

Historical and Current Range/Current Status This species is known from more than 20 populations totaling approximately 1,000 individuals in and around the Pohakuloa Training Area

on the island of Hawaii (Robert Shaw, Colorado State University, pers. comm. 1996). Historically, this species was also found on Hualalai and Puu Huluhulu on Hawaii and possibly Ulupalakua on Maui, but it no longer occurs at these sites (O'Connor 1999).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. Feral ungulates (pigs, goats, and sheep) are the major threat to *Festuca hawaiiensis* (Loyal Mehroff, U.S. Fish and Wildlife Service (Service), pers. comm. 1996; R. Shaw, pers. comm. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitats on the island of Hawaii. The pig (*Sus scrofa*) is originally native to Europe, northern Africa, Asia Minor, and Asia. European pigs, introduced to Hawaii by Captain James Cook in 1778, became feral and invaded forested areas, especially wet and mesic forests and dry areas at high elevations. They are currently present on the island of Hawaii and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Medeiros *et al*. 1986; Scott *et al*. 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al*. 1999).

The goat (*Capra hircus*), a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently populations exist on Kauai, Oahu, Maui, and Hawaii. Goats browse on introduced grasses and native plants, especially in drier and more open ecosystems. Feral goats eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. They are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al*. 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990).

Sheep (*Ovis aries*) have become established on the island of Hawaii (Tomich 1986) since their introduction almost 200 years ago (Cuddihy and Stone 1990). Sheep roam the upper elevation dry forests of Mauna Kea, Mauna Loa, and Hualalai (above 1,000 meters (3,300 feet)), causing damage similar to that of goats (Stone 1985). Sheep have decimated vast areas of native forest and shrubland on Mauna Kea and continue to do so as a managed game species (Stone 1985; Cuddihy and Stone 1990).

Ungulate exclusion fences protect a portion of known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Pigs, goats, and sheep eat leaves and other parts of this species (L. Mehroff, pers. comm. 1996; R. Shaw, pers. comm. 1996).

D. The inadequacy of existing regulatory mechanisms.
Pigs, goats, and sheep are managed in Hawaii as a game animal, but many herds, especially of pigs and goats, populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Goat, pig, and sheep hunting is allowed year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources n.d.-a, n.d.-b, n.d.-c). However, public hunting does not adequately control the number of pigs to eliminate this threat to *Festuca hawaiiensis*. Ungulate exclusion fences protect a portion of known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

E. Other natural or manmade factors affecting its continued existence.
The majority of the known plants occurs on military lands and may be directly threatened by military activities, including fires from training activities, trampling by troops and vehicles, as well as extinction from stochastic events (L. Mehroff, pers. comm. 1996; R. Shaw, pers. comm. 1996; Service 2003). In addition, numerous weed species highly threaten *Festuca hawaiiensis* (L. Mehroff, pers. comm. 1996; R. Shaw, pers. comm. 1996).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a). Several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998) indicate nonnative plant species may outcompete native plants similar to *Festuca hawaiiensis*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to habitat of *Festuca hawaiiensis*, the Service believes nonnative plant species are a threat to *Festuca hawaiiensis*. The remaining unmanaged populations of *Festuca hawaiiensis* are still impacted by this threat.

Nonnative plants are being controlled in a portion of the known populations of this species, but

will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands. Many widespread alien taxa cannot be completely eradicated from an island or the State, and therefore are expected to disperse into previously managed areas (Loope 1998, Smith 1985). The remaining populations of the species are still impacted by this threat.

Because Hawaiian plants were subjected to fire during their evolution only in areas of volcanic activity and from occasional lightning strikes, they are not adapted to recurring fire regimes and do not quickly recover following a fire. Alien plants are often better adapted to fire than native plant species, and some fire-adapted grasses have become widespread in Hawaii. Native shrubland and dry forest can thus be converted to land dominated by alien grasses. The presence of such species in Hawaiian ecosystems greatly increases the intensity, extent, and frequency of fire, especially during drier months or drought. Fire-adapted alien plant taxa can reestablish in a burned area, resulting in a reduction in the amount of native vegetation after each fire. Fire can destroy dormant seeds as well as plants, even in steep or inaccessible areas. Fires may result from natural causes, or may be accidentally or purposely started by humans. At Pohakuloa, fires are often started by military training (Cuddihy and Stone 1990; Marie Bruegmann, Service, pers. comm. 2004).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Pono Pacific Land Management, a private environmental conservation company that offers restoration services to landowners and public agencies, partnered with the Service to restore native plant habitat at Puu Anahulu on the island of Hawaii. This project includes construction of three ungulate exclosures, nonnative plant removal, and outplanting of *Festuca hawaiiensis*. To date, exclosures and water catchments have been constructed to support outplanting efforts. Endangered plant recovery units have been identified and firebreaks are established.

SUMMARY OF THREATS:

The major threats to this taxon are ungulates, fire, and nonnative plant species, which are believed to be a major cause of the decline of this species throughout its range. Feral pigs, goats and sheep have been fenced out of a portion of the populations where *Festuca hawaiiensis* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the populations that are fenced. These on-going conservation efforts for this species benefit only a portion of the known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

LISTING PRIORITY:

| THREAT | | | |
|---|---|---|---|
| Magnitude | Immediacy | Taxonomy | Priority |
| **High** | **Imminent** | Monotypic genus<br>**Species** | 1<br>**2*** |

| | | | |
|---|---|---|---|
| | Non-imminent | Subspecies/population<br>Monotypic genus<br>Species<br>Subspecies/population | 3<br>4<br>5<br>6 |
| Moderate to Low | Imminent | Monotypic genus<br>Species<br>Subspecies/population | 7<br>8<br>9 |
| | Non-imminent | Monotypic genus<br>Species<br>Subspecies/population | 10<br>11<br>12 |

**Rationale for listing priority number**:

*Magnitude:*

This species is highly threatened by pigs, goats, and sheep that degrade and destroy habitat, by nonnative plants that outcompete and displace it, and by military training. Threats to dry montane forest habitat of *Festuca hawaiiensis* and to individuals of this species occur throughout its range, and are expected to continue or increase without their control or eradication. Feral pigs, goats and sheep have been fenced out of a portion of the populations where *Festuca hawaiiensis* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the populations that are fenced. These on-going conservation efforts for this species benefit only a portion of the known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

*Imminence:*

Threats to *Festuca hawaiiensis* from pigs, goats, sheep, nonnative plants, and military training are imminent because they are ongoing.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted?

No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. Feral pigs, goats and sheep have been fenced out of a portion of the populations where *Festuca hawaiiensis* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the populations that are fenced. In addition, a private environmental conservation company partnered with the Service to construct ungulate exclosures, control nonnative plants, and outplant *Festuca hawaiiensis* at Puu Anahulu on the island of Hawaii. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *F. hawaiiensis* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use

of emergency listing procedures.

DESCRIPTION OF MONITORING:
Much of the information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communication with Loyal Mehrhoff, Service, in 1996 and Robert Shaw, Colorado State University, in 1996. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. New information regarding fire impacts from military training was provided by Marie Bruegmann, Service, on threats to this species in 2004. In 2005 we contacted the species experts listed below, but received no new information on this taxon.

The Hawaii Natural Heritage Program identified this species as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Rare (could be considered at risk) by Wagner *et al*. (1999b).

Species experts were contacted but did not provide new information this year, no new literature was found, and no known entities are studying this species. However, it is highly likely that the previously reported threats continue to impact the species at the same or an increased level.

COORDINATION WITH STATES:
In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED
List all experts contacted:

| Name | Date | Place of Employment |
|---|---|---|
| 1. Joel Lau | June 28, 2005 | Hawaii Natural Heritage Program |
| 2. Art Medeiros | June 28, 2005 | U.S.G.S. Biological Resources Discipline |
| 3. Jim Jacobi | June 28, 2005 | U.S.G.S. Biological Resources Discipline |
| 4. Rick Warshauer | June 28, 2005 | U.S.G.S. Biological Resources Discipline |
| 5. Hank Oppenheimer | June 28, 2005 | Maui Land and Pineapple Company |
| 6. Kapua Kawelo | June 28, 2005 | U.S. Army |
| 7. Dave Lorence | June 28, 2005 | National Tropical Botanical Garden |
| 8. Steve Perlman | March 29, 2005 | National Tropical Botanical Garden |
| 9. Ken Wood | August 2, 2005 | National Tropical Botanical Garden |
| 10. Marie Bruegmann | July 13, 2005 | U.S. Fish and Wildlife Service |
| 11. Vickie Caraway | June 14, 2005 | Hawaii Division of Forestry and Wildlife |

List all databases searched:

| Name | Date |
|---|---|
| 1. Hawaii Natural Heritage Program | 2004 |

Other resources utilized:


Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.

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Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.

Culliney, J.L. 1988. Islands in a Far Sea; Nature and Man in Hawaii. Sierra Club Books, San Francisco. 410 pp.

Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai`i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.

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Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.

Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.

Hawaii Heritage Program, The Nature Conservancy of Hawaii. 1990. Management recommendations for Na Pali Coast State Park, island of Kauai. Unpublished report prepared for Hawaii, Department of Land and Natural Resources, Division of State Parks, Honolulu. 18 pp.

Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.

Loope, L.L. 1998. Hawaii and Pacific Islands. Pp. 747-774. In: M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran (eds.). Status and Trends of the Nation's Biological Resources, Volume 2. U.S. Department of the Interior, U.S. Geological Survey, Reston,

VA.
Loope, L., F. Starr and K. Starr. 2004. Management and research for protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.
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Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.
Medeiros, A.C., Jr., L.L. Loope, and R.A. Holt. 1986. Status of native flowering plant species on the south slope of Haleakala, East Maui, Hawaii. Coop. Natl. Park Resources Stud. Unit, Hawaii, Techn. Rept. 59: 1-230.
Meyer, J.-Y. and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvescens* D.C. (Melastomataceae). Journal of Biogeography 23: 775-781.
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Stone, C.P. 1985. Alien animals in Hawai`i's native ecosystems: toward controlling the adverse effects of introduced vertebrates: *in* Stone, C.P., and J.M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 251-297.
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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: Acting _____ 11/10/05
Regional Director, Fish and Wildlife Service Date

_____

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: September 16, 2005
Conducted by: Marie M. Bruegmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 22, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 13, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 13, 2005
Field Supervisor